Claim 3 has been cancelled. The feature of claim 3 has been added to claim 1.

Claims 25 through 29 have been added. Support for the cylindrical posts of claim 25 is at least found at lines 29 to 31 of page 5. Support for the square cross section posts of claim 26 is at least found at lines 30 to 34 of page 18 and lines 27 to 29 of page 5. Support for the oval shape and diamond shape cross section posts of claim 27 is at least found at lines 30 to 34 of page 18. Claim 28's a surface of the posts comprising a material which is in contact with the liquid crystal material, excluding a material which induces homeotropic alignment in liquid crystal materials is at least found at lines 27 to 28 of page 11. Claim 29's second surface alignment inducing a local homeotropic alignment of the director is at least found between line 32, page 6 and line 9, page 7.

Claims 1 and 3 through 34 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,456,348 to Bryan-Brown et al. (hereinafter "the Bryan-Brown et al. patent").

Claim 1 is directed to a bistable nematic liquid crystal device comprising: a first cell wall and a second cell wall enclosing a layer of nematic liquid crystal material; electrodes for applying an electric field across at least some of the liquid crystal material; a surface alignment on the inner surface of at least the first cell wall providing alignment to the liquid crystal molecules; wherein the surface alignment comprises an array of posts which have at least one of a shape and an orientation to induce a liquid crystal director adjacent the posts to adopt two different tilt angles in substantially the same azimuthal direction; the arrangement being such that two stable liquid crystal molecular configurations can exist after suitable electrical signals have been applied to the electrodes.

The Bryan-Brown et al. patent describes a bistable nematic liquid crystal device in which the liquid crystal molecules are aligned by a surface alignment monograting.

Applicants respectfully submit that the Bryan-Brown et al. patent fails to disclose or suggest a surface alignment comprising an array of posts, as in claim 1. The alignment grating of the Bryan-Brown et al. patent is a grooved surface. The Office Action incorrectly asserts that the "small pillars" of the Bryan-Brown et al. patent are posts, as in claim 1. The small pillars of the Bryan-Brown et al. patent are "for assisting in correct spacing apart of the cell walls and also for a barrier to liquid crystal material flow when the cell is flexed." (col. 3, lines 59 to 61). Clearly the "surface alignment grating", not the "small pillars", of the Bryan-Brown et al. patent are used for aligning the liquid crystal material: "a surface alignment grating on at least one cell wall that permits the liquid crystal molecules to adopt two different pretilt angles in the same azimuthal plane." (col. 3, lines 30 to 32). The small pillars are simply for spacing the cell walls and as a barrier to material flow. In contrast, the posts of claim 1 provide the alignment of the liquid crystal material. (see page 5, lines 15 and 16). Furthermore, the present invention provides for "taller posts," which are clearly different than the "posts" of claim 1, for cell spacing. (page 8, lines 13 and 14). Therefore, Applicants respectfully submit that claim 1 is patentably distinguishable over the cited art.

Applicants respectfully submit that claims 3 through 24 which depend from claim 1 are also patentably distinguishable over the cited art for at least the reasons discussed above in relation to claim 1.

Claim 4 adds the feature that the posts have a height in the range of about 0.5 to 5 μm.

Applicants respectfully submit that the Bryan-Brown et al. patent fails to disclose or suggest posts having a height in the range of about 0.5 to 5 μm, as in claim 4. The "1-3 μm height" cited by the Office Action refers to the height of the "small pillars" discussed above in relation to claim 1 as not being "posts" or having any alignment function. The Bryan-Brown et al. patent does not describe the height of posts. Therefore, claim 4 is further patentably distinguishable over the cited art.

Claim 5 adds the features that the posts have a height in the range of about 0.9 to 1.3 μm and the spacing between the cell walls is about 3 μm.

Applicants respectfully submit that the Bryan-Brown et al. patent fails to disclose or suggest posts having a height in the range of about 0.9 to 1.3 μm for at least the reasons discussed above in relation to claim 4. Therefore, claim 5 is further patentably distinguishable over the cited art.

Claim 7 adds the features that at least part of the side wall of the posts is tilted at a tilt angle with respect to the normal to the plane of the first cell wall, and that the tilt angle is in the range of about 5 to 7°.

Applicants respectfully submit that the Bryan-Brown et al. patent fails to disclose or suggest at least part of the side wall of the posts being tilted at a tilt angle with respect to the normal to the plane of the first cell wall in the range of about 5 to 7°. The Office Action asserts that column 9, lines 54 through 58 describes tilt angle of the side wall of the posts. However, the cited portion of the Bryan-Brown et al. patent describes the angle from parallel between the grating groove directions on one cell wall and the rubbing alignment directions of the rubbed polymer surface of PI32 polyimide on the opposite cell wall. (see col. 9, lines 10 through 58). The Bryan-Brown et al. patent clearly fails to disclose or suggest the tilt angle of posts, let alone a tilt angle in the range of about 5 to 7°,

as recited in claim 7. Therefore, claim 7 further distinguishes over the Bryan-Brown et al. patent.

Claim 8 adds the features that at least part of the side wall of the posts is tilted at a tilt angle with respect to the normal to the plane of the first cell wall, and that the tilt angle is about 5°.

Applicants respectfully submit that claim 8 further distinguishes over the cited art for at least the reasons discussed above in relation to claim 7.

Claim 10 adds the feature that the posts are arranged in one of a random or pseudorandom array.

Applicants respectfully submit that the Bryan-Brown et al. patent further fails to disclose or suggest an arrangement in one of a random or pseudorandom array. Figure 4 and lines 1 through 6 on page 14 of the present application show a pseudorandom array of posts. The Office Action asserts that column 3, line 46 through column 4, line 4 describes an arrangement in one of a random or pseudorandom array. However, the relevant portion of the cited area states that "The gratings may be applied to both cell walls and may be the same or different shape on each wall. Furthermore, the grating profile may vary within each pixel area, and or in the inter pixel gaps between electrodes." (col. 3, lines 46 through 49). This only describes varying the grating profile and does not disclose or suggest randomness or pseudorandomness, let alone arranging the posts in a random or pseudorandom array, as in claim 10. Therefore, claim 10 further distinguishes over the Bryan-Brown et al. patent.

Claim 22 adds the features that the liquid crystal director twists between the first cell wall and the second cell wall, and that the twist is induced by chiral doping of the liquid crystal material.

Applicants respectfully submit that the Bryan-Brown et al. patent, contrary to the assertion of the Office Action, teaches away from the twist being induced by chiral doping of the liquid crystal material. The cited portion of the patent states "A cholesteric dopant...may be added to *prevent* twist disclinations." (col. 9, lines 54 and 55, emphasis added). Claim 22 describes chiral doping for the purpose of inducing twist, not preventing twist. Therefore, the Bryan-Brown et al. patent fails to disclose or suggest the liquid crystal director twists between the first cell wall and the second cell wall, wherein the twist is induced by chiral doping of the liquid crystal material, as in claim 22.

Therefore, it is respectfully submitted that claim 1, as well as claims 3 through 34, which depend from independent claim 1, are patentably distinguishable over the cited art. Reconsideration and withdrawal of the § 102(e) rejection of these claims are respectfully requested.

Claim 2 is rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,456,348 to Bryan-Brown et al. (hereinafter "the Bryan-Brown et al. patent") in view of PCT Publication WO 01/34251 to Jones et al. (hereinafter "the Jones et al. patent")

The Bryan-Brown et al. patent is described above. The Jones et al. patent describes a bistable nematic liquid crystal device in which one cell wall has a grating structure capable of sustaining two stable states in which the liquid crystal director is in the same azimuthal plane but at two different tilt angles out of the plane of the cell. The second cell wall has a monostable surface which leads to substantially planar homogeneous alignment. The monostable surface can be formed from a rubbed polymer or a grating surface.

Claim 2 depends from claim 1 and adds the features that the liquid crystal material has negative dielectric anisotropy, and that the second cell wall has a surface alignment which induces a local homeotropic alignment of the director.

Applicants respectfully submit that, as discussed above, the Bryan-Brown et al. patent fails to disclose or suggest a surface alignment comprising an array of posts, as in claim 1. The Bryan-Brown et al. patent describes the use of a liquid crystal material with a positive dielectric anisotropy and fails to disclose or suggest that the liquid crystal material has a negative dielectric anisotropy, as in claim 2.

The Jones et al. patent fails to disclose or suggest a surface alignment comprising an array of posts, as in claim 1. Furthermore, the Jones et al. patent fails to disclose or suggest that the second cell wall has a surface alignment which induces a local homeotropic alignment of the director, as in claim 2. Homeotropic alignment is such that the director is oriented perpendicular to the plane of the cell walls. In contrast the cited passage from the Jones et al. patent describes a first bistable surface and a "surface alignment on the other cell wall giving a single preferred alignment direction of the liquid crystal molecules, either planar homogeneous or tilted homogeneous alignment." (page 6, lines 14 through 23). Planar homogenous alignment is such that the director is aligned along the plane of the cell wall and tilted homogeneous alignment is such that the director is at an angle to the cell wall but substantially planar to the cell wall. (see page 1, lines 22 through 28 of the present application). The planar and tilted homogeneous alignments of the Jones et al. patent do not disclose or suggest the homeotropic alignment of claim 2.

Therefore, there would be no motivation for one of ordinary skill in the art to modify the liquid crystal device having a grating surface alignment, a liquid crystal material of positive dielectric anisotropy, and monostable homeotropic second surface of the Bryan Brown et al. patent with the liquid crystal device having a grating surface alignment, a liquid crystal material of negative dielectric anisotropy, and a monostable substantially planar second surface of the Jones et al. patent to arrive at the liquid crystal device of claim 2. Even if one could be

motivated to combine the references, which is not admitted here, both the Bryan-Brown et al. patent and the Jones et al. patent fail to disclose or suggest a surface alignment comprising an array of posts, as in claim 1 and thus claim 2. Applicants respectfully submit that claim 2 is patentably distinguishable over the cited art and the cited combination. Reconsideration and withdrawal of the § 103(a) rejection of these claims are respectfully requested.

Accordingly, Applicants respectfully submit that all claims presented in this application patentably distinguish over the prior art. Therefore, Applicants respectfully request favorable consideration and passage of the application to allowance.

Respectfully submitted,

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Marked-Up Version of the Claims

1. (Twice Amended) A bistable nematic liquid crystal device comprising:

a first cell wall and a second cell wall enclosing a layer of nematic liquid crystal material;

electrodes for applying an electric field across at least some of said~~the~~ liquid crystal material;

a surface alignment on the inner surface of at least ~~the~~ said first cell wall providing an alignment to the liquid crystal molecules;

wherein ~~the~~ said surface alignment comprises an array of ~~features~~ posts which have at least one of a shape and an orientation to induce ~~the~~ a liquid crystal director adjacent ~~the~~said ~~feature~~posts to adopt two different tilt angles in substantially the same azimuthal direction;

the arrangement being such that two stable liquid crystal molecular configurations can exist after suitable electrical signals have been applied to ~~the~~ said electrodes.

2. (Amended) A device as claimed in claim 1, wherein ~~the~~ said liquid crystal material has negative dielectric anisotropy and wherein ~~the~~ said second cell wall has a surface alignment which induces a local homeotropic alignment of ~~the~~ said liquid crystal director.

3. (Cancelled)

4. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts have a height in the range of about 0.5 to 5 μm.

5. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts have a height in the range of about 0.9 to 1.3 μm and the spacing between the cell walls is about 3 μm.

6. (Amended) A device as claimed in claim ~~3~~1, wherein at least part of ~~the~~ a side wall of ~~the~~ said posts is tilted at a tilt angle with respect to the normal to the plane of ~~the~~ said first cell wall.

7. (Twice Amended) A device as claimed in claim 6, wherein ~~the~~ said tilt angle is in the range of about 5 to 7°.

8. (Amended) A device as claimed in claim 6, wherein ~~the~~ said tilt angle is about 5°.

9. (Twice Amended) A device as claimed in claim 1, wherein ~~each~~said ~~feature~~ posts each ~~haves~~ a width in the range of about 0.2 to 3 μm.

10. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts are arranged in one of a random or pseudorandom array.

11. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts are spaced in the range of about from 0.1 to 5 μm apart from each other.

12. (Amended) A device as claimed in claim 1, wherein ~~the~~ said liquid crystal material contains a surfactant.

13. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts are formed from at least one of a photoresist or a plastics material.

15. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts each have a surface comprising a material which is in contact with said liquid crystal material~~are treated with a material~~, excluding any material which induces homeotropic alignment in liquid crystal materials.

16. (Twice Amended) A device as claimed in claim 1, wherein ~~the~~ said second wall has a surface alignment ~~on the second cell wall~~ comprisinges an array of features which have at least one of a shape and an orientation to induce ~~the~~ a liquid crystal director adjacent the features to adopt two different tilt angles in substantially the same azimuthal direction.

17. (Amended) A device as claimed in claim 1, wherein ~~the~~ said liquid crystal material has a pleochroic dye dissolved therein.

18. (Twice Amended) A device as claimed in claim 1, wherein said at least one of the shape and the orientation of ~~the~~said ~~features~~ posts is such as to favour only one azimuthal director orientation adjacent ~~the~~said ~~feature~~posts, and this orientation is the same for each ~~feature~~post.

19. (Twice Amended) A device as claimed in claim 1, wherein said at least one of the shape and the orientation of ~~the~~said ~~features~~ posts is such as to favour only one azimuthal director orientation adjacent ~~the~~ said ~~feature~~posts, and this orientation varies from ~~feature~~post to ~~feature~~post so as to give a scattering effect in one of the two stable liquid crystal molecular configurations~~two states~~.

20. (Amended) A device as claimed in claim 1, wherein ~~the~~ an inner surface of ~~the~~ said second cell wall is provided with an alignment which induces ~~the~~ a local liquid crystal director to adopt a planar alignment in substantially the same azimuthal direction induced by the alignment on the surface of the first cell wall.

21. (Amended) A device as claimed in claim 1, wherein ~~the~~ said liquid crystal director twists between ~~the~~ said first cell wall and ~~the~~ said second cell wall.

22. (Amended) A device as claimed in claim 21, wherein ~~the~~ said twist is induced by chiral doping of ~~the~~ said liquid crystal material.

23. (Twice Amended) A device as claimed in claim 21, wherein ~~the~~ said twist is induced by treatment of ~~the~~ said second cell wall to produce one of a planar or a tilted planar alignment of ~~the~~ a local liquid crystal director at a non-zero angle to the azimuthal direction induced by ~~the~~said ~~features~~ posts on ~~the~~ said first cell wall.

24. (Amended) A device as claimed in claim 1, wherein ~~the~~said ~~features~~ posts are formed from a material, excluding any material which induces homeotropic alignment in liquid crystal materials.

25. (New) A device as claimed in claim 6, wherein said posts are cylindrical.

26. (New) A device as claimed in claim 6, wherein said posts have a square cross section.

27. (New) A device as claimed in claim 1, wherein said posts have a cross section selected from an oval shape and a diamond shape.

28. (New) A bistable nematic liquid crystal device comprising:

a first cell wall and a second cell wall enclosing a layer of nematic liquid crystal material;

electrodes for applying an electric field across at least some of said liquid crystal material;

a first surface alignment on the inner surface of said first cell wall and a second surface alignment on the inner surface of said second cell wall providing alignment to the liquid crystal molecules;

wherein said first surface alignment comprises an array of posts which have at least one of a shape and an orientation to induce a liquid crystal director adjacent said posts to adopt two different tilt angles in substantially the same azimuthal direction;

said posts each having a surface comprising a material which is in contact with said liquid crystal material, excluding a material which induces homeotropic alignment in liquid crystal materials;

the arrangement being such that two stable liquid crystal molecular configurations can exist after suitable electrical signals have been applied to said electrodes.

29. (New) A bistable nematic liquid crystal device comprising:

a first cell wall and a second cell wall enclosing a layer of nematic liquid crystal material;

electrodes for applying an electric field across at least some of said liquid crystal material;

a first surface alignment on the inner surface of said first cell wall and a second surface alignment on the inner surface of said second cell wall providing alignment to the liquid crystal molecules;

wherein said first surface alignment comprises an array of posts which have at least one of a shape and an orientation to induce a liquid crystal director adjacent said posts to adopt two different tilt angles in substantially the same azimuthal direction;

said posts each having a surface comprising a material which is in contact with said liquid crystal material, excluding a material which induces homeotropic alignment in liquid crystal materials;

said second surface alignment inducing a local homeotropic alignment of a liquid crystal director;

the arrangement being such that two stable liquid crystal molecular configurations can exist after suitable electrical signals have been applied to said electrodes.